Letters to the Editor

Indian J. Phys. **48**, 841–843 (1974)

Electronic property of photosensitive film on silver in solutions of bromine in acetic acid

JUDAS FRANCO AND N. K. PATEL

Chemistry Department, Bhavan's R A College of Science, Khanpur, Ahmedabad-1

(*Received* 26 *May* 1973, *revised* 8 *December* 1973)

When electrolytic silver is subjected to the chemical action of bromine in acetic acid silver bromide is formed. Silver bromide is photosensitive and its use in photography is well known. Various theories for latent image formation on silver bromide is also well known. But the formation of an image on metallic silver without using any sensitizer or developer has not been reported. In the present work, an attempt has been made to study the electronic property of the film formed on silver, when treated with bromine solution in acetic acid, and to bring out a correlation between the time of image formation with change in electronic property. Mechanism for photoimage formation has been suggested.

A silver specimen of composition 99·8% Ag was used, cleaned and polished according to the method suggested by Champion (1952). The cleaned silver coupon was immersed in 0·1 *M* bromine solution in acetic acid. The photo current produced when one surface of the treated plate was exposed to sunlight and the other surface shielded from sunlight, was noted. The experimental procedure was adopted according to that described in previous publication (Franco & Patel 1973).

Different spectral regions of the sun light was used to study the maximum effect of photoimage formation, using filters.

Bromine solution in acetic acid reacts with silver forming silver bromide according to the reactions

$$\text{i)}\quad Br_2 \xrightarrow{h\nu} Br_2^{*}\ (\text{excited}) \rightarrow Br + Br$$

$$\text{ii)}\quad Ag + Br \xrightarrow{h\nu} AgBr\ (\text{film}).$$

Barshchevskii (1968) reported that the photocurrent ($i = f\lambda$) and the spectral characteristics for silver bromide varies with layer thickness. The cause of such

variation is the relative changes in the number of surface light absorption centers and internal photoelectric effects and volume centers (dissociating excitons) The photocurrent maxima in AgBr caused by photoelectric effect correspond to wavelength 365 nm and that caused by dissociating excitons correspond to 430 nm. The study of AgBr film formation on silver plate and its electronic property has not been reported.

Vissible photo image formation takes place on the treated plate; without using fixers or sensitizers. When sunlight is incident on it keeping the object in the path of light.

It was found that region of solar spectrum between 300–360 nm was most effective. The exposed part of the film was deep violet while the unexposed part of the film remained yellowish green in shade Figure 1 shows variation of photo current with time.

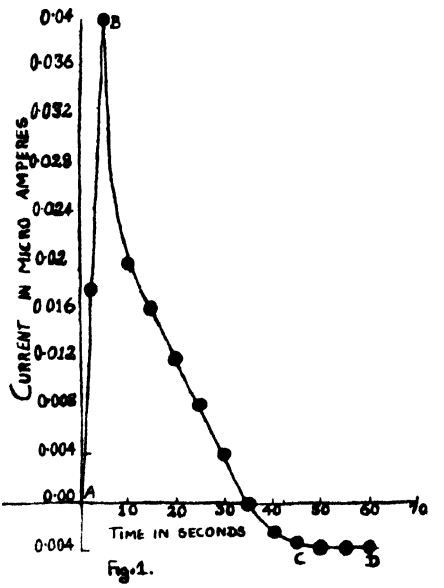

Fig. 1. Curves represent the photo current with time.

The increase in current from A to B may be due to the photochemical reaction between AgBr film and solvent molecules.

$$\text{AgBr} + \text{solvent} \xrightarrow{h\nu} \text{AgBr} - - - - \text{solvent}\ (\text{complex})$$

The time of photoimage formation falls within this period i.e., growth of photocurrent from A to B.

The current changes from B to C due to variation of the composition of the film product i.e. from AgBr to Ag_2O. The levelling of current in the part BC

may be due to AgBr—solvent complex decomposing in presence of adsorbed oxygen to form Ag_2O.

$$2AgBr\underset{(complex)}{\text{— — — —Solvent}} + O_2 \xrightarrow{h\nu} Ag_2O + \text{other products}$$

The levelling of current in part *BC* may be due to AgBr and Ag_2O junction, both being semiconductors forming the junction. Moreover, when the plate containing the image is dipped in bromine solution, the image is erased, and the image reappears on re-exposure in the same manner. This effect can be repeated a number of times, so that it gives photomemory effect. Such an effect with Cu_2O film on copper and brass has been reported (Franco & Patel 1973)

The current flow could be reversed by exposure to oxygen and sunlight and is attributed to photo induced adsorption and de-adsorption of lattice oxygen atoms (Danialli *et al* 1964)

References

Barshchevskii B. U. 1968 *Fiz. Tverd. Tela.* **10**, 3689.

Champion F. A. 1952 *Corrosion Testing Procedures*, Chapman& Hall, London, pp. 187.

Damalli J. F., Pankhurst K. G. A. & Riddefad A. C. 1964 *Recent Progress in Surface Science*, Vol. I, Academic Press, p. 236.

Fanco J. & Patel N. K. 1973 *Corros. Sci.* **13**, 553.

Fanco J. & Patel N. K. 1973 *J. Electro. Chem. Soc. India* **22**, 172.

Indian J. Phys. **48**, 843 845 (1974)

Dual Alfven waves in superfluids with high electrical conductivity

P. G. Amte

Department of Physics, Rajaram College, Kolhapur, Maharashtra.

(*Received* 10 *December* 1973, *revised* 29 *April* 1974)

It is well known (Alfven 1950, Landau & Lifshitz 1963, Little 1967) that in a fluid with very high electrical conductivity a magnetohydrodynamic or Alfven wave can be generated. The velocity of propagation of such a wave is $(B_0/\mu\rho)^{\frac{1}{2}}$, where B_0 is the magnetic induction in the fluid, μ is the permeability and ρ the density of the fluid.